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FERTILIZATION OF RAMIE WITH AMMONIUM SULFATE [1]

DAVID MA. DAZA

WITH FOUR TEXT FIGURES

David [2] observed that ramie is usually grown on rich soil in Davao. To guard against a decrease in yield, the leaves, stems, and pulp are returned to the soil after the fiber has been extracted, and sulfate of ammonia is applied at the rate of 200 kilograms a hectare.

Robinson [3] states that unless the fertility of ramie soil is maintained in some way, poor yields are obtained the second year and thereafter. Cruz [4] recommends that ramie fields be top-dressed annually, preferably with ammonium sulfate, at the rate of from 250 to 500 kilograms a hectare.

Four commercial varieties of ramie are grown at present in the College of Agriculture. The effects upon these ramie varieties of varying amounts of ammonium sulfate applied in combination with cut leaves, flower, pulp, and baggasse which were returned to the field after each harvest, were studied from July, 1948, to March, 1950, in the Department of Agronomy, College of Agriculture, Los Baños, Laguna.

MATERIALS AND METHODS

Varieties

One-year-old plants of Saikeiseisin, Guiran Taipan No. 1, Formosa, and Kogai, which were studied by Belisario [5] in 1949, were used in the present work. Each variety was grown in three replications.

Land

Sixteen plots of 30 sq. m. each were used. A large portion of the land is high and level.

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[1] Experiment Station Contribution No. 1592. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, April, 1951. Prepared in the Department of Agronomy, under the direction of Dr. Pedro A. David.

[2] DAVID, P. A. 1939. Ramie and its cultivation in Davao. Philippine Agriculturist 28: 38–43.

[3] ROBINSON, B. B. 1946. Ramie fiber production. U.S. Dept. Agric. Cir. 585.

[4] CRUZ, E. E. 1946. Ramie culture in the Philippines. Philippine Dept. Agric. and Comm. News Bull. 1(3): 24–31.

[5] BELISARIO, M. C. 1949. A comparative study of four varieties of ramie. Philippine Agriculturist 32: 185–214.

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Fertilizer

Ammonium sulfate fertilizer, containing about 20.6 per cent nitrogen, was used at the rates of 300, 400, and 500 kilograms a hectare, or 900, 1,200 and 1,500 grams to a plot of 30 square meters.

Before the fertilizer was applied, the matured stalks were cut close to the ground without injuring the lateral roots. After each plot had been weeded by hands, the fertilizer was spread evenly around the hills of the ramie plants. All cut leaves, stems, ends, butts, pulp, and bagasse which were left after extraction of the fiber from the stalks were returned to the plots. The first required amounts of the fertilizer were applied as top-dressing to the plots on September 9, 1948, the second on December 18, 1948, and the third on March 11, 1949. Application of the fertilizer was done soon after each harvest.

RESULTS AND DISCUSSION

General appearance of the plants

The moderate rainfalls in September and December, 1948, improved the growth of the ratoon plants in the first crop. As expected, the plants in the fertilized plots grew more luxuriantly than those in the untreated plots, except some insignificant ones which were not favorably situated in the field. As a whole, the fertilized plants had large green leaves, thick stems, and abundant seed clusters. In general the plants in the different plots were not uniform in growth on account of the various treatments and of the difference in variety.

The second ratoon plants or crop from the stumps of the first harvest appeared rather unhealthy, although the fertilized plots significantly outranked the untreated plots. The unfertilized plants had few leaves, flowers, and seed clusters and were stunted in growth. This unusual condition was mainly due to the scarcity of rain from the latter part of December, 1948, to March, 1949.

From March to May, the growth and appearance of the ratoon plants from the second crop were just as bad as, or worse than, those from the preceding one. In June and July, however, when rains fell more or less regularly, the plants, especially those in the fertilized plots, became vigorous.

The plants in the first and third crops were very mildly affected by the Cercospora leaf spot, whereas those in the second were severally attacked. The scarcity of water probably caused the poor stand of the plants in the second crop.

Number of stalks

In general the yield of ramie fiber is related to the number of stalks produced by each plant, hence the effect of ammonium sulfate fertilizer on the production of stalks was studied. In the first

crop the addition of fertilizer at the height of the rainy season, from August to November, 1948, increased significantly the number of stalks except for variety Kogai, in which the control and the 300-kilogram application showed no significant difference in the mean number of stalks produced (table 1). The plots that received 500-kilogram treatment produced the greatest number of stalks among the other three varieties. However, irrespective of the treatments, Guiran Taipan No. 1 significantly produced more stalks than the rest of the ramie varieties in the first crop.

Similarly, in the second crop, the application of ammonium sulfate significantly increased the number of stalks in all the varieties, except in the 300- and 400-kilogram rates. As in the first crop, the 500-kilogram rate was the best in the production of more stalks to a hill. Unlike in the first harvest, Saikeiseisin, not Guiran Taipan No. 1, produced the most number of stalks. This might have been due to the diverse amount of rainfall during the growing period of each variety.

In the third crop, which was grown partly during the dry season, the 400-kilogram application yielded more stalks than either the 500- or the 300-kilogram rate. Saikeiseisin also produced the largest number of stalks, followed in descending order by Guiran Taipan No. 1, Kogai, and Formosa.

It may be summed up, that in general, the higher rates of nitrogen application resulted in an increase in the number of stalks of the four varieties in the three harvests whenever there was an adequate amount of moisture.

Height of plants

The average height of plants in the fertilized plots (table 2a) ranged from 108 to 141 cms., whereas that of the untreated plot was 92 cms. In the first crop, the 400-or the 500-kilogram application produced taller plants than those in the 300-kilogram treatment and in the control. The tallest plants were those of Formosa and Saikeiseisin and the shortest, Kogai.

Similarly, the fertilizer treatment produced significantly taller plants in the second crop. However, the 300- and the 500-kilogram rates produced taller stalks than the 400-kilogram application, doubtless owing to uneven distribution of rainfall. As in the first harvest, Formosa and Saikeiseisin ranked first in height of plants.

In the third harvest, either the 500- or the 400-kilogram application resulted in taller plants for Guiran Taipan No. 1 than for any of the other varieties (table 2b). Although the plants were significantly taller than those in the control, the 300-kilogram rate proved inferior to either the 400- or the 500-kilogram application.

The third harvest had the tallest plants among all the varieties, probably because of the long growing period of around five months

(March to August), in contrast with three months each in the first (August to November) and second (December to March) harvest.

Branching tendency

The application of ammonium sulfate in either the first, the second or the third harvest had no pronounced effect on the tendency of the stems to produce branches (table 3). This condition is advantageous, as unbranched and straight stems in ramie are desirable in fiber production.

Maturity period

The average length of time for the four varieties in the unfertilized cultures to attain maturity was 80 days, whereas those in the fertilized cultures reached maturity significantly earlier, 65 to 73 days (table 4). When 400 or 500 kilograms of ammonium sulfate was applied, Saikeiseisin was significantly the earliest to mature (63 days). The 300-kilogram rate required a shorter period for the plants to attain maturity (59 days). The differences in the number of days for the four varieties to mature were statistically insignificant, indicating that the varying rates of application of the fertilizer had no influence on the lapse of time before the stalks could be harvested.

In the third harvest the maturity of the ramie plants significantly depended on the kind of treatment and on the variety. The 500-kilogram treatment required the shortest period for the plants to attain maturity (111 days). Saikeiseisin was significantly the earliest to mature in any of the fertilizer applications.

An analysis of the time of maturity in the three harvests shows that the growing period of the varieties was influenced by both the fertilizer treatments and the season of culture. The transition period from the wet- to the dry-weather conditions in the second harvest offset any possible effect of ammonium sulfate on the maturity of the four varieties. Although the growing period of the third crop, in which a combination of dry- and wet-season conditions prevailed, was appreciably lengthened, fertilizer application significantly shortened the growing period of each variety.

Yield of dry fiber

In the first harvest the mean yields from the fertilized plots were strikingly greater than that of the control by 140 per cent in the 300-kilogram treatment, 211 per cent in the 400-kilogram treatment, and 223 per cent in the 500-kilogram treatment (table 5). The apparent increase in yield, however, between the 400- and the 500-kilogram application was insignificant. Irrespective of treatment, Saikeiseisin (fig. 1) significantly outyielded all the other varieties.

Fig. 1.—Fiber yield of Saikeiseisin in the third harvest (Photographed by Olive).

In the second harvest the 300-kilogram rate resulted in 418 per cent increase in yield of dry fiber over the control; the 400-kilogram rate, 594 per cent; and the 500-kilogram rate, 1153 per cent. Saikeiseisin produced significantly more fiber than Formosa, (fig. 2) but not more than either Guiran Taipan No. 1 (fig. 3) or Kogai (fig. 4).

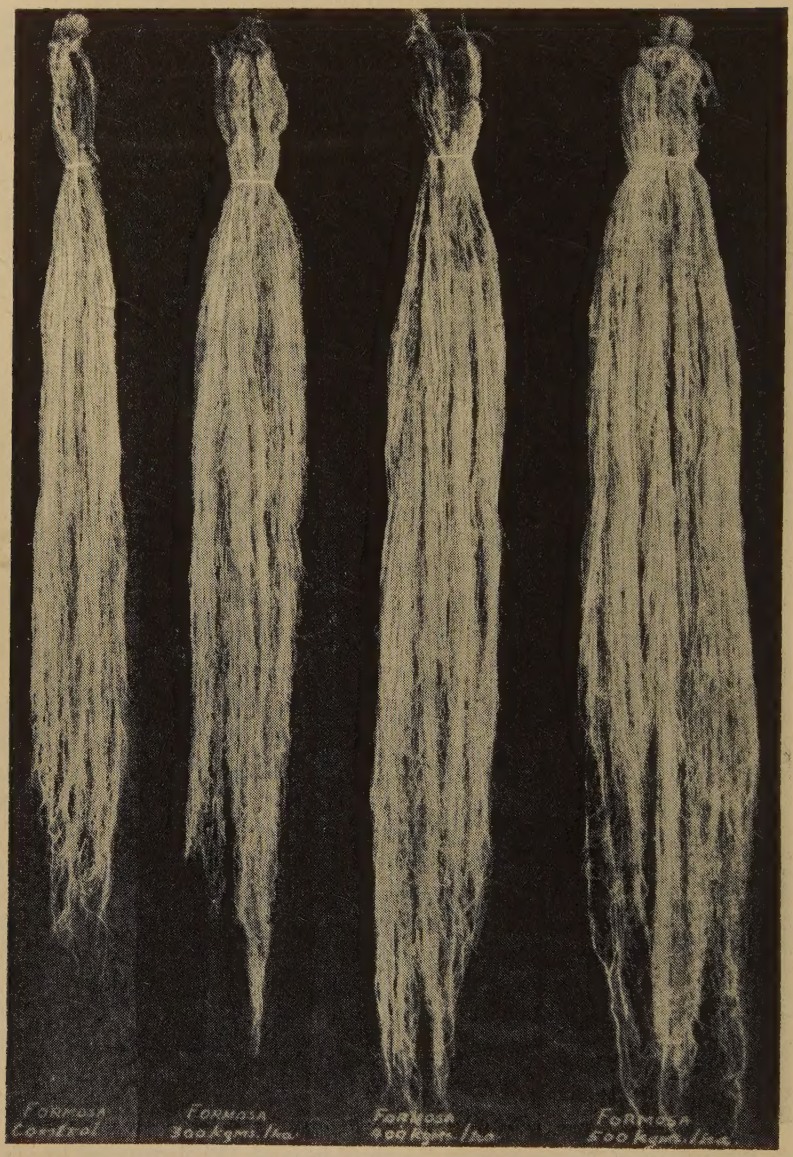

Fig. 2.—Fiber yield of Formosa in the third harvest (Photographed by Olive).

In the third harvest the increase in yield from the 500-kilogram application was 242 per cent over that of the control; the 400-kilogram application, 215 per cent; and the 300-kilogram application, 126 per cent. All rates of fertilizer application considered, Guiran Taipan No. 1 produced significantly more fiber than any of the other varieties.

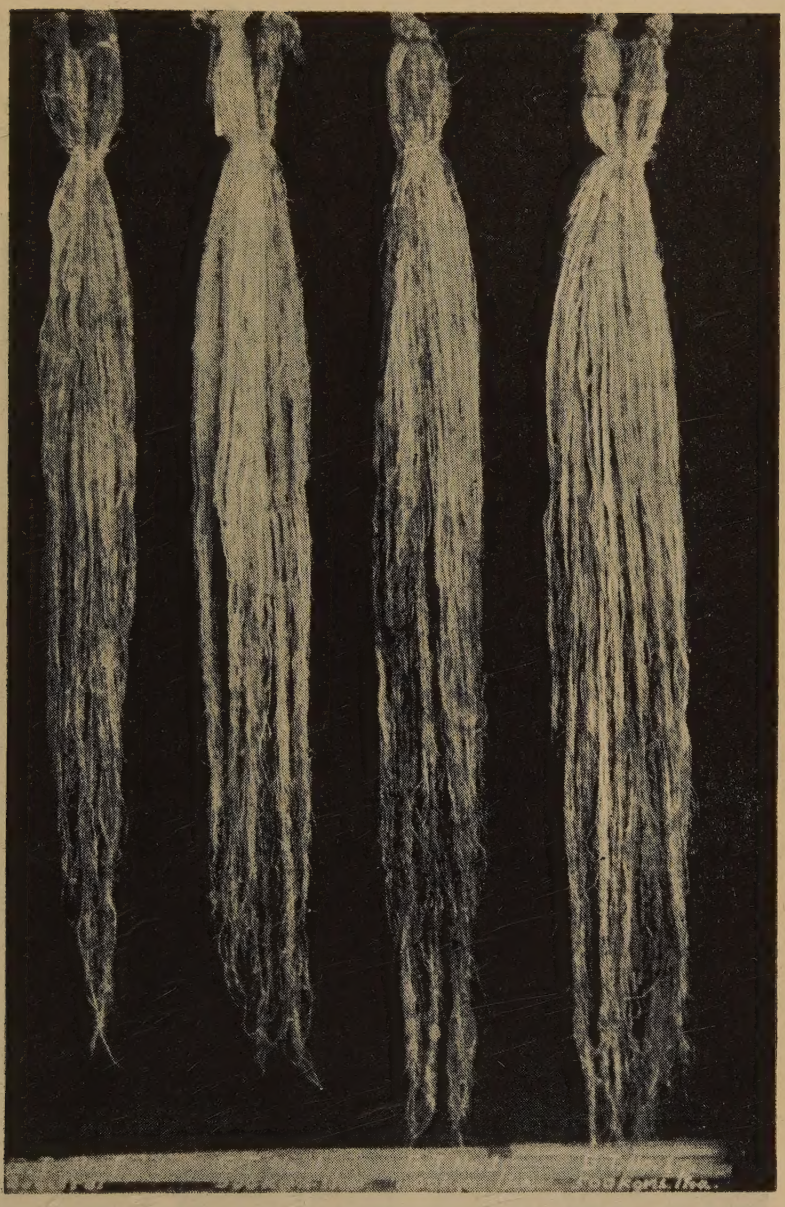

Fig. 3.—Fiber yield of Guiran Taipan No. 1 in the third harvest (Photographed by Olive).

The differences in performance of the four varieties were presumably due to varying weather conditions during the growing season of the plants. The scarcity of rain at the height of the dry

season prolonged the growing period of the third crop to five months, March to August, with the corresponding increase in fiber production. On the other hand, the growing period of the second crop, December to March, three months toward the close of the rainy season, was characterized by more or less frequent but not torrential rainfall, hence the fertilizer was not as much washed away from

Fig. 4.—Fiber yield of Kogai in the third harvest (Photographed by Olive).

the soil as in the case of the first crop, the growing period of which was at the height of the rainy season, August to December.

SUMMARY

1. The ramie varieties Saikeiseisin, Formosa, Guiran Taipan No. 1, and Kogai fertilized with ammonium sulfate at the rates of 300, 400, and 500 kilograms to the hectare produced significant increases in number of stalks in three harvests, depending on the amount of rainfall during the growing period.

2. In mean height, the fertilized plants of the four varieties differed significantly from those of the control in all the harvests. The third gave the tallest plants among all the varieties, probably on account of the longer growing period of five months, in contrast with three months each in the first and second harvests.

3. The application of ammonium sulfate in either the first, the second or the third crop in the four varieties had no pronounced effect on stalk-branching.

4. The average length of time for the four varieties to attain maturity was significantly shorter in the fertilized plots than in the control. The time to attain maturity was influenced by either the fertilizer treatment, season or variety.

5. The three rates of application of ammonium sulfate increased significantly the yield of dry fiber over the control. The following rates, with their respective varieties, significantly produced the most fiber: first harvest, 300 or 400-kilogram rate with Saikeiseisin; second harvest, 500-kilogram, Saikeiseisin; third harvest, 400-kilogram, Guiran Taipan No. 1. The differences in performance of the four varieties in the first, second, and third crops, were presumably due to the variations in the weather conditions during each growing period.

TABLE 1

Number of stalks of four varieties of ramie at different rates of application of ammonium sulfate in the first cutting

TREATMENTS	REPLICATION	VARIETIES				TOTAL OF TREATMENTS	MEAN NUMBER OF STALKS
		S.K.	G.T. No. 1	Formosa	Kogai		
Control	1	274	840	127	147		
	2	92	861	131	304		
	3	244	819	140	143		
	Sum	610	2,520	398	594	4,122	344
	Mean	203	840	133	198		
300	1	820	989	938	205		
	2	263	995	847	194		
	3	598	895	994	143		
	Sum	1,681	2,879	2,779	542	7,881	657
	Mean	560	960	926	181		
400	1	668	907	493	480		
	2	817	932	398	492		
	3	673	960	437	239		
	Sum	2,158	2,799	1,328	1,211	7,496	625
	Mean	719	933	443	404		
500	1	694	1,112	838	764		
	2	639	940	891	730		
	3	794	1,050	882	712		
	Sum	2,127	3,102	2,611	2,206	10,046	837
	Mean	709	1,034	870	735		
Total of Variety		6,576	11,300	7,116	4,553	29,545	
Mean Variety		508	942	593	379		

L.S.M.D. = 81.192 at 5% level.

TABLE 2a

Height of four varieties of ramie at different rates of application of ammonium sulfate in the first cutting

TREATMENTS	REPLICATION	VARIETIES				TOTAL OF TREATMENTS	MEAN HEIGHT
		S.K.	G.T. No. 1	Formosa	Kogai		
		cms.	*cms.*	*cms.*	*cms.*		
Control	1	78	124	49	90		
	2	108	119	77	83		
	3	70	130	86	94		
	Sum	256	373	212	267	1,108	92
	Mean	85	124	71	89		
300	1	119	98	123	69		
	2	128	132	150	74		
	3	126	99	92	69		
	Sum	373	329	365	212	1,279	108
	Mean	124	110	122	71		
400	1	122	123	165	124		
	2	164	152	164	132		
	3	132	151	150	104		
	Sum	418	426	479	360	1,683	140
	Mean	139	142	160	120		
500	1	158	129	128	128		
	2	158	134	154	154		
	3	136	120	157	138		
	Sum	452	383	439	420	1,694	141
	Mean	151	128	146	140		
Total of Variety		1,499	1,511	1,495	1,259	5,764	
Mean Variety		125	126	125	105		

L.S.M.D. = 12.24 at 5% level.

TABLE 2b

Height of four varieties of ramie at different rates of application of ammonium sulfate in the third cutting

TREATMENTS	REPLICATION	VARIETIES				TOTAL OF TREATMENTS	MEAN HEIGHT
		S.K.	G.T. No. 1	Formosa	Kogai		
		cms.	*cms.*	*cms.*	*cms.*		
Control	1	145	180	74	160		
	2	120	110	66	150		
	3	110	110	60	140		
	Sum	375	400	200	450	1,425	119
	Mean	125	133	67	150		
300	1	40	240	165	174		
	2	70	235	150	180		
	3	90	230	140	136		
	Sum	200	705	455	490	1,850	154
	Mean	67	235	152	163		
400	1	180	240	190	190		
	2	170	230	185	180		
	3	165	240	180	150		
	Sum	515	710	555	520	2,300	192
	Mean	172	237	185	173		
500	1	200	198	190	210		
	2	195	200	180	200		
	3	180	180	170	180		
	Sum	575	578	540	590	2,283	190
	Mean	192	193	180	197		
Total of Variety		1,665	2,393	1,750	2,050	7,858	
Mean Variety		139	199	146	171		

L.S.M.D. = 14.28 at 5% level.

TABLE 3

Number of branching stalks of four varieties of ramie at different rates of application of ammonium sulfate in the first cutting

TREATMENTS	REPLICATION	VARIETIES				TOTAL OF TREATMENTS	MEAN BRANCHING STALKS
		S.K.	G.T. No. 1	Formosa	Kogai		
Control	1	0	3	9	2		
	2	0	6	4	4		
	3	0	2	0	1		
	Sum	0	11	13	7	31	3
	Mean	0	4	4	2		
300	1	7	9	3	4		
	2	8	4	5	7		
	3	6	0	0	1		
	Sum	21	13	8	12	54	5
	Mean	7	4	3	4		
400	1	2	4	2	5		
	2	3	4	1	2		
	3	9	0	4	4		
	Sum	14	8	7	11	40	3
	Mean	5	3	2	4		
500	1	5	0	2	11		
	2	8	3	1	14		
	3	5	3	5	4		
	Sum	18	6	8	29	61	5
	Mean	6	2	3	10		
Total of Variety		53	38	36	59	186	
Mean Variety		4	3	3	5		

L.S.M.D. = 2.3460 at 5% level.

TABLE 4

Number of days required by the four varieties of ramie to attain maturity stage at different rates of application of ammonium sulfate in the first cutting

TREATMENTS	REPLICATION	VARIETIES				TOTAL OF TREATMENTS	MEAN DAYS OF MATURITY
		S.K.	G.T. No. 1	Formosa	Kogai		
Control	1	69	79	87	86		
	2	70	75	88	78		
	3	67	77	89	88		
	Sum	206	231	264	252	953	80
	Mean	69	77	88	84		
300	1	55	71	72	81		
	2	60	70	80	85		
	3	62	75	79	87		
	Sum	177	216	231	253	877	73
	Mean	59	72	77	84		
400	1	65	81	59	67		
	2	56	77	54	65		
	3	58	73	56	69		
	Sum	179	231	169	201	780	65
	Mean	60	77	56	67		
500	1	65	80	60	64		
	2	70	78	61	63		
	3	62	79	63	68		
	Sum	197	237	184	195	813	68
	Mean	66	79	61	65		
Total of Variety		759	915	848	901	3,423	
Mean Variety		63	76	71	75		

L.S.M.D. = 2.6316 at 5% level.

TABLE 5

Average dry-fiber yield in grams per plot of four varieties of ramie at different rates of application of ammonium sulfate in the first cutting

TREATMENTS	REPLICATION	VARIETIES				TOTAL OF TREATMENTS	MEAN DEY-FIBER
		S.K.	G.T. No. 1	Formosa	Kogai		
		gms.	*gms.*	*gms.*	*gms.*		
Control	1	125	208	58	67		
	2	63	231	68	155		
	3	78	192	72	85		
	Sum	266	631	198	307	1,402	117
	Mean	89	210	66	102		
300	1	768	336	249	118		
	2	456	334	180	73		
	3	253	290	271	49		
	Sum	1,477	960	700	240	3,377	281
	Mean	492	320	233	80		
400	1	356	250	340	254		
	2	760	280	524	263		
	3	394	373	406	173		
	Sum	1,510	903	1,270	690	4,373	364
	Mean	503	301	423	230		
500	1	460	311	460	290		
	2	302	266	586	233		
	3	584	290	554	202		
	Sum	1,346	867	1,600	725	4,538	378
	Mean	449	289	533	242		
Total of Variety		4,599	3,361	3,768	1,962	13,690	
Mean Variety		383	280	314	164		

L.S.M.D. = 85.68 at 5% level.

THE POSSIBLE USE OF VARIOUS CHARACTERS IN SEXING NEWLY HATCHED LOS BAÑOS CANTONESE CHICKS [1]

F. M. Fronda and Atanacio A. Simon
Of the Department of Animal Husbandry

Sex identification by sex-linkage in crossbred chicks is now fairly popular in many countries. The Japanese cloacal method is now commonly practiced in the United States, Canada, England, Japan, and Australia. Both methods of sex identification, however, are quite complicated and cannot be used to advantage by the average poultryman. Can a more practical method of sexing chicks based on other characters be used? To answer this question, this study was made from December, 1946, to September, 1947, in the Department of Animal Husbandry of this College.

A total of 821 artificially hatched Los Baños Cantonese chicks were legbanded at hatching time and weighed in a Cenco balance with a maximum capacity of 2000 grams and sensitive to one-tenth of a gram. They were brooded in fireless brooders and given the College standard chick ration supplemented with all the green feed they could consume.

The sex of the chicks that died during the brooding period was determined by opening them and examining the sex organs. In the living chicks, the secondary sexual characters were used for determining the sex at the end of the brooding period, when they were 12 weeks of age. In most cases, however, the sex could be easily determined by the secondary sex characters when the chicks were only seven weeks old.

Characters observed. The relation of sex to the sequence of hatch was determined by placing the chicks at hatching time into four lots as follows: lot I, those hatched during the first six hours; lot II, those during the second six hours; lot III, those during the third six hours; and lot IV, those during the fourth six hours.

When the chicks were taken out of the incubator about 18 hours after the last chicks have hatched, the length of the first anterior primary wing feather was measured. This feather was marked with ink and measured again on the third and on the sixth day.

The color of the down of each chick, whether dark gold (cadmium yellow),[2] light gold (deep chrome), pale gold (light orange yellow), or golden yellow (empire yellow) was determined. Also noted were the presence or absence of a spot on the head of the

[1] Experiment Station Contribution No. 1593. Prepared from the thesis presented by the junior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1948.

[2] Ridgeway, R. 1912. Color standards and color nomenclature. iii + 42 p., 53 pl. Baltimore, Md.: A. Hoen and Company.

chick and the inclination of its comb, whether it was inclined to the right or left, or upstanding.

RESULTS AND DISCUSSION

Relation of sequence of hatch to sex

A significantly greater number of females than males were observed during the first six hours of hatching, about an equal number of males and females during the second and third six hours, and a significantly greater number of males than females during the fourth six hours (table 1). This observation corroborates those of Hays (1941), and Smyth and Cairns (1944), who found that females predominated in the first chicks to hatch, and males in the last. The chicks that hatched between the first and the last six hours were about equal in the number of males and females. Fronda and Infante (1948) reported that among ducklings those that hatched during the first two 4, or first 8 hours, were mostly females; those during the second two 4, or second 8 hours, produced an equal proportion of males and females; and those hatched during the last two 4, or last 8 hours, were mostly males. In the present study, the percentages of males in the different lots were 35.61 in lot I, 49.66 in lot II, 50.80 in lot III, and 71.20 in lot IV.

Of the 821 chicks studied, 406, or 49.45 per cent, were males and 415, or 50.55 per cent, were females (table 1). The difference between these two figures was not significant.

Weights of chicks at hatch

The weights of the chicks at hatch ranged from 20.1 grams to 35 grams for the males and from 19.6 grams to 34.5 grams for the females; the mean weight of the former was 26.8 grams and that of the latter 26.4 grams. Of the 414 chicks with head spots, 159, or 30.40 per cent, were males and the rest, 255, or 61.60 per cent, were females. On the other hand, of the 407 chicks that did not have head spots, 247, or 60.68 per cent, were males and only 160, or 39.32 per cent, were females. It appears that those birds with a spot on the head were likely to be females, 61.60 per cent, and that those without were males, 60.68 per cent. Although these figures are better than the 50.50 chance, it is believed that the presence or absence of the head spot cannot be used with a fair degree of accuracy as a basis for sexing Los Baños Cantonese chicks.

The sex of Barred Plymouth Rock may be determined at hatch by using the regularity of the outline of the head spot as a basis (Warren, 1942). Warren (1942) also stated that Jerome claimed that he could identify sex in Barred Plymouth Rock chicks with an accuracy of 90 per cent on the basis of the regularity of the outline of the head spot rather than the size of the spot, those having irregularly outlined and scattered head spots being males and those having more regularly outlined head spots, females. He claimed an accuracy of 90 per cent or better for sexing on the basis of the head

spot only, and 95 per cent if the color of the legs was also considered. Jeffrey and Thompson (1943) noted the females to be either dark gold, light gold, or pale gold, whereas the golden yellow birds tended to be males rather than females. The males among the 207 chicks that had a dark-gold down were 90, or 42.46 per cent; among the 217 chicks that had light-gold down, 104, or 47.92 per cent; and among the 206 chicks that had a pale-gold down, 96, or 46.60 per cent. The only down color that predominated among males was the golden yellow, for out of the 191 chicks that had this color, 116, or 60.52 per cent, were males. These figures indicate that the color of the down cannot be considered as a good basis for sexing Los Baños Cantonese chicks at hatch.

According to Warren (1942), Byerly and Quinn reported in 1936 that among Rhode Island Reds, there is sex difference in the down color, the females tending to show spots or stripes of darker color on the head and back. Warren (1942) also reported that Quinn and Know in 1939 could sex Barred Plymouth Rock chicks with 87 per cent accuracy by using as basis the intensity of the black pigment in the down and legs.

SUMMARY

1. Of the 821 Los Baños Cantonese chicks used in this study, 49.45 per cent were males and 50.55 per cent were females.

2. There was a significantly greater number of females than males during the first six hours of hatching, about an equal number of males and females during the second and third six hours, and a significantly greater number of males during the fourth six hours.

3. Although the male Los Baños Cantonese chicks were significantly heavier at hatch than the females, the weight cannot be considered as a good basis for sexing newly hatched chicks.

4. The primary feathers of the female Los Baños Cantonese chicks were significantly longer at the time of hatch, and grew considerably faster than those of the males. The length of the primary feathers may be used as basis for sexing the three-day-old chicks.

5. The presence or absence of the head spot, the inclination of the comb, and the down color cannot be considered as good bases for sexing newly hatched Los Baños Cantonese chicks.

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TABLE 1

The relation between the sequence of hatch and sex of Los Baños Cantonese chicks

TIME	LOT I 1ST 6 HOURS		LOT II 2ND 6 HOURS		LOT III 3RD 6 HOURS		LOT IV 4TH 6 HOURS		TOTAL BIRDS OBSERVED	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Observed	78	141	144	146	95	92	89	36	406	415
Expected	109.5	109.5	145	145	93.5	93.5	62.5	62.5	410.5	410.5
X^2	9.0616		0.0069		0.0240		11.2520		0.0986	
Probability	0.01		.96		.91		.01		.84	
Percentage of males	35.61		49.66		50.80		71.20		49.45	

TABLE 2

Distribution of the weights of the chicks at hatch

MALES			FEMALES		
Class range	Class value	Frequency	Class range	Class value	Frequency
grams	*grams*		*grams*	*grams*	
19.6–20.8	20.2	5	19.6–20.8	20.2	5
20.9–22.1	21.5	7	20.6–22.1	21.5	8
22.2–23.4	22.8	22	22.2–23.4	22.8	25
23.5–24.7	24.1	40	23.5–24.7	24.1	68
24.8–26.0	25.4	85	24.8–26.0	25.4	82
26.1–27.3	26.7	84	26.1–27.3	26.7	100
27.4–28.6	28.0	74	27.4–28.6	28.0	60
28.7–29.9	29.5	37	28.7–29.9	29.5	36
30.0–31.2	30.6	27	30.0–31.2	30.6	12
31.3–32.5	51.9	9	31.3–32.5	51.9	13
32.6–33.8	33.2	4	32.6–33.8	33.2	3
33.9–35.1	34.5	6	33.9–35.1	34.5	5

Analysis of Variance

	MALES	FEMALES
Mean weight, grams	26.8	26.4
Sum of deviation squared from mean	2918.94	2690.76
Standard deviation	2.63	2.54
Standard error	0.1305	0.1246
Standard error of difference	0.1477	
Computed "t"	2.84	
Tabular "t"	1.9596	

TABLE 3a

Distribution of the length of the most anterior primary feathers at hatch

MALES		FEMALES	
Class value	Frequency	Class value	Frequency
mm.		*mm.*	
1	1	1	0
2	11	2	1
3	27	3	2
4	62	4	16
5	107	5	46
6	107	6	103
7	53	7	119
8	30	8	61
9	5	9	35
10	3	10	23
11	0	11	6
12	0	12	3

Analysis of Variance

	MALES	FEMALES
Mean length, mm.	5.21	6.96
Sum of deviation squared from mean	967.0267	1113.3417
Standard deviation	1.54	1.64
Standard error	0.0764	0.0805
Standard error of difference	0.1109	
Computed "t"	15.78	
Tabular "t"	1.9579	

TABLE 3b

Distribution of the length of the most anterior primary feathers after three days

MALES		FEMALES	
Class value	Frequency	Class value	Frequency
mm.		*mm.*	
3	1	3	0
4	5	4	0
5	12	5	0
6	41	6	0
7	49	7	5
8	78	8	13
9	98	9	18
10	84	10	50
11	17	11	71
12	6	12	117
13	0	13	52
14	0	14	61
15	0	15	14
16	0	16	4
17	0	17	1
18	0	18	3

Analysis of Variance

	MALES	FEMALES
Mean length, mm.	8.38	12.11
Sum of deviation squared from mean	1068.2592	1401.5169
Standard deviation	1.65	1.85
Standard error	0.0834	0.0914
Standard error of difference	0.1237	
Computed "t"	30.15	
Tabular value of "t"	1.9579	

TABLE 3c

Distribution of the length of the most anterior primary feathers after six days

MALES		FEMALES	
Class value	Frequency	Class value	Frequency
mm.		*mm.*	
7	17	7	0
8	28	8	0
9	32	9	0
10	58	10	0
11	46	11	5
12	62	12	8
13	43	13	8
14	61	14	29
15	17	15	38
16	10	16	78
17	2	17	85
18	0	18	69
19	0	19	59
20	0	20	31
21	0	21	7

Analysis of Variance

	MALES	FEMALES
Mean length, mm.	11.50	16.84
Sum of deviation squared from area	1995.55	1611.27
Standard deviation	2.30	2.02
Standard error	0.1186	0.1016
Standard error of difference	0.1561	
Computed "t"	34.20	
Tabular value of "t"	1.9599	

TABLE 4

Number and sex of chicks with spot on the head at hatch

SPOT ON THE HEAD	TOTAL OBSERVED		MALE		FEMALE	
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
Present	414	50.42	159	30.40	255	61.60
Absent	407	40.58	247	60.68	160	39.32
Total	821		406		415	

TABLE 5

Relation of inclination of the comb to the sex of the chicks at hatch

INCLINATION OF COMB	TOTAL OBSERVED		MALE		FEMALE	
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
Neutral	13	1.60	9	69.23	4	30.77
Right	405	49.30	199	40.14	206	50.86
Left	403	49.10	198	47.72	205	50.86
Total	821		406		415	

TABLE 6

Distribution of the color of the down and the sex of the chicks at hatch

COLOR OF DOWN	TOTAL OBSERVED		MALE		FEMALE	
	Number	*Per cent*	*Number*	*Per cent*	*Number*	*Per cent*
Dark gold	207	23.29	90	42.46	117	57.54
Light gold	217	26.40	104	47.92	113	32.08
Pale gold	206	23.10	96	46.60	110	54.40
Golden yellow	191	23.50	116	60.52	75	39.48
Total	821		406		415	

THE EFFECT OF DISTANCE OF PLANTING UPON THE YIELD OF HEADGREEN SOYBEAN [1]

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Aragon [2] recommended that soybeans for seed purposes should be planted 40 cm. between the hills in furrows 60 to 80 cm. apart.

Rodrigo [3] described three methods of planting soybeans, namely, (*a*) by broadcast, (*b*) by drill and, (*c*) by hills. Broadcast is generally employed when soybeans are used for forage, green manure, and cover crop purposes. The drill method, which is not generally practiced in the Philippines, is commonly used when the crop is planted for hay. The hill method is the one most commonly used for seed production. In this method, rows from 50 to 80 cm. apart are laid and the seeds are planted in hills 25 to 40 cm. in the rows. This distancing of the rows allows the use of animal-drawn cultivators.

Maetze [4] stated that in Java and Bali soybeans are planted after the rice crop in irrigated land and after sugar cane or tobacco in dry land. After the rice harvest, the soybean seeds are broadcast or planted in rows 30 cm. apart and 25 cm. between the hills in the row.

According to Hamilton (1936), corn planters equipped with plates which have openings or cups suitable to the size of the beans are commonly used in planting soybeans.

Post (1937) reported that Hulbert and Spence recommended the planting of soybeans in rows, like corn or navy beans, in hills 20 to 24 inches (50.8 to 60.96 cm.) apart and two seeds to the hill.

Piper and Morse (1923) reported that in Japan, furrows are made about two feet (60.96 cm.) apart and the seeds are sown, two or three together, about 10 inches (25.4 cm.) apart. This method is extensively used in central and northern Manchuria.

Burlison, van Doren, and Hackleman (1940) got good yield by planting soybeans in 24-inch rows (60.96 cm.), with the use of a bean drill.

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[1] Experiment Station contribution No. 1594. Prepared from the thesis of the junior author presented in March, 1943, for graduation with the degree of Bachelor of Science in Agriculture.

[2] ARAGON, V. B. 1934. How to grow soybeans. Stockman and Farmer 3 (2): 3–4, 24, 31.

[3] RODRIGO, P. A. 1937. Soybean culture in the Philippines. Philippine Dept. Agric. and Comm. Cir. 2.

[4] MAETZE, C. J. I. 1938. History and the culture of soybean. Agric. Life 6(5): 8.

Rodrigo and Urbanes (1940) using 75 cm. as distance between the rows and 25 to 30 cm. between the hills in the rows, got an average yield of 30.3 cavans a hectare for the wet-season culture and 20.1 cavans for the dry-season, with the Headgreen variety.

Zahnley (1939) said that with the use of a corn planter, good yields were obtained from lands that are free from weeds. By using a corn planter and with a distance of 63.34 cm. between the rows and 80 cm. between the hills, he reported an average yield of 13.19 bushels per acre (11.553 cavans a hectare) in six years.

EXPERIMENTS, RESULTS, AND DISCUSSION

The area of the land was about 4,000 square meters each for the wet- and dry-season cultures. The land used for the dry-season crop was previously planted to cassava (*Manihot utilissima* Pohl) and the land for the wet-season culture, to edible canna (*Canna edulis* Kir.).

The field for both cultures was divided into 20 plots of 200 square meters each. The treatments were distributed at random among the plots. Each treatment was replicated five times in both cultures.

The Headgreen soybean, which Fermin [5] reported as one of the three promising imported varieties tried in this College, was used in this experiment. The seeds for the dry-season planting were taken from the wet-season crop of the Division of Annual Farm Crops of the Department of Agronomy. Those for the wet-season culture were obtained from the harvest of the dry-season planting of this experiment. Seeds which were almost uniform in size, color, and maturity were selected.

The dry-season culture was planted on November 26, 1940, and harvested on February 28, 1941. The wet-season culture was planted on June 1, 1941, and harvested from October 4 to 6, 1941.

Distances tried. The different lots, or treatments, were numbered from I to IV. The distances between the furrows was maintained at 70 cm. in all the treatments; only the distances between the hills in the furrows varied as follows: 30 cm. in lot 1, 40 cm. in lot II, 50 cm. in lot III, and 60 cm. in lot IV.

In both cultures, five seeds were dropped in each hill and immediately covered with 4 cm. to 6 cm. of soil. The missing hills were replanted five and six days after planting in the dry-season and in the wet-season cultures, respectively. The hills were thinned to three plants 12 days after planting in the dry-season and 11 days after planting in the wet-season culture.

The plants were cultivated with an animal-drawn implement as soon as they were big enough to withstand a little rough handling.

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[5] FERMIN, F. A. An acclimatization test of nine newly introduced varieties of soybean in the College of Agriculture. (Thesis presented for graduation from the College of Agriculture. 1935. Unpublished).

In the dry-season culture the first cultivation, or off-barring, was done three weeks after planting. Three weeks later the field was again cultivated with a five-tooth cultivator; hilling up was done after a week.

In the wet-season culture the first off-barring was done after a month on account of heavy rains. The field was then hilled up a week after the first cultivation.

Piper and Morse (1923) recommend weeding as soon as the seedlings appear. In the present study the weeds between the hills were hoed only whenever it was necessary.

The soybeans were harvested when they turned yellow and before all the seeds were dry to prevent loss of seeds from bursting of the pods.

In the dry season the plants were pulled up and not cut with a bolo and were bundled in the morning of the following day to prevent loss of seeds.

The harvests from both cultures were dried separately, threshed by beating them with a flail, winnowed and cleaned.

The percentages of non-marketable seeds for both cultures were determined by sorting.

Germination. The plants germinated in about five days in all the treatments for both cultures. The average germination in the dry season was 45 per cent in lot I, 44 per cent in lot II, 44 per cent in lot III, and 43 per cent in lot IV. In the wet season the germination was 54 per cent in lot I, 52 per cent in lot II, 53 per cent in lot III, and 52 per cent in lot IV. The low percentage of germination in the dry season may be attributed to insufficient moisture in the soil and in the wet season, to the heavy rains after planting. The differences in percentages of germination of the different treatments were statistically insignificant.

Blooming and maturity. Flowers appeared in all the treatments in the dry season 40 days after planting. The flowering and the maturity were not uniform. Some plants were already dry while a few in the same lot were still green. The plants were harvested 95 days from the date of planting to save the plants that matured ahead. In the dry season there was no difference in the age of maturity of the plants of the different treatments.

In the wet season, flowers appeared in all plots after 48 days. The pods of the plants in the different treatments matured practically at the same time. Lots I and II were ready for harvesting at the age of 121 days, lot III at 122 days, and lot IV at 123 days.

Pests and diseases. No serious pests and diseases were observed in both cultures.

Nature and growth. The plants in the dry season showed no apparent difference in growth from planting to blooming. At the time of blooming the plants were generally erect in every plot. At

maturity the plants in the plots with greater distances were slightly more stocky and bunchy than the ones with closer distances. The more closely distanced plants appeared slightly taller and more slender. At the close of the blooming period the plants in lots I and II showed a tendency to lodge. Later on, however, lodging was more in the 30 cm. treatment, or lot I, than in lot II. Lots III and IV showed no sign of lodging until harvesting time.

The plants in the different treatments in the wet-season crop hardly differed in growth from planting to about blooming period. The plants in lot I crowded each other after 44 days and in lot II, after 46 days. The farther the distance between the plants, the more weedy were the plots. This may be explained by the fact that the weeds were easily controlled by the plants when the distances between the hills were closer. Sixty-five days after planting, the spaces between the furrows in lot I were covered with vines. The plants in lot III were just beginning to crowd each other. By this time lodging was observed in both lots I and II, although there was more lodging in the former. The plants in lots I and II lodged completely 69 days after planting. The plants in lot III lodged at the age of 75 days. Those in lot IV had a very slight tendency to lodge. It was observed that the greater the distance of planting, the bigger was the stem, whereas the closer the distance, the weaker and more slender were the plants.

Comparative yields of seeds and straw

Table I shows the actual and mean yields of seeds of the dry-season culture. Lot I gave the highest mean yield, followed by lots II, III, and IV, in descending order; the difference due to treatments was highly significant. The value of the least significant mean difference was 1.52 kg. a plot. Using this value as the basis of comparison between the means of the treatments, lot I gave significantly higher yield than any of the other treatments. Likewise, lots II and III gave significantly higher yields than lot IV. However, there was no significant difference in yield of seeds between lots II and III. The computed yields of seeds, in cavans a hectare, are as follows: 7.243 for lot I; 5.742 for lot II; 5.300 for lot III; and 3.691 for lot IV. The difference due to treatments was highly significant, showing that the treatments were responsible for the increase in yield. Lot I gave significantly higher yield than any of the other treatments. Similarly, lots II and III gave significantly higher yield of marketable seeds than lot IV. There was no significant difference in mean yield between lots II and III.

The actual and mean yields of non-marketable seeds in the dry-season culture gave insignificant variation. There was a very low yield of non-marketable seeds because of the more uniform maturity of pods and ease in drying the plants.

Lot I gave the highest yield of straw in the dry-season culture, followed in descending order by lots II, III, and IV. However, the differences due to treatments were insignificant.

Table 2 shows the actual and mean yields of seeds of the wet-season crop. Lot I gave the highest mean yield to a plot, followed in descending order by lots II, III, and IV. The differences in yields were due to the treatments. The least significant mean difference was 3.16 kg. to a plot. When this value was used as a test of significance, lot I gave a significantly higher yield of seeds than any of the other treatments. Lot II gave a significantly higher yield than lot IV, but the differences between lots II and III, and between lots III and IV were insignificant.

The actual and mean yields of marketable seeds in the wet-season culture ranged from 16.788 kg. in lot IV to 21.318 kg. in lot I. Lot I gave a significantly higher yield of marketable seeds than any of the other treatments. There were no significant differences in yield among lots II, III, and IV.

The treatments had marked effect upon the yield of non-marketable seeds; the computed value of F for treatments was significant. Lot I produced significantly higher yield of non-marketable seeds than any of the other treatments. However, the differences in yield among the other treatments were insignificant.

The high yield of non-marketable seeds in lots I, II, and III in the wet-season culture may be due to the weak and slender plants which easily lodged after the formation of pods. The heavy rains during the maturity period caused the seeds of the ripe pods to germinate. Moreover, the plants in the lots of shorter distances had more immature pods than those planted farther apart.

The actual and mean yields of straw in the wet-season culture were highest in lot I, 44.4 kg. a plot, and lowest in lot IV, 37.8 kg. The treatments did not have any significant effect upon the yield of straw.

SUMMARY

1. The distances between hills in planting soybean did not have any significant effect upon germination and blooming. Neither were differences in yield of straw for dry-season and wet-season cultures affected by the distance of planting.

2. For both the dry- and wet-season cultures, the best distance of planting soybean for seeds was 70 cm. between the furrows, and 30 cm. between the hills in the furrows.

3. The high yield of non-marketable seeds in the wet-season culture was due to the lodging of the plants and the uneven maturity of pods in crowded plants.

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TABLE 1

The actual and computed mean yields of seeds in kilograms to a plot in the dry-season culture as influenced by the different treatments

TREATMENT	PLOTS					TREATMENT TOTAL	TREATMENT MEAN
	1	2	3	4	5		
I	8.59	9.19	6.42	8.99	8.10	41.29	8.258
II	8.40	8.01	5.44	5.44	5.44	32.73	6.546
III	7.01	6.42	4.54	6.61	5.63	30.21	6.042
IV	5.43	4.84	4.84	3.16	2.76	21.03	4.208
						Grand total	
Total	29.43	28.46	21.24	24.20	21.93	125.26	25.054
Plot mean ..	7.357	7.115	5.310	6.050	5.483	General mean	6.263

Least significant mean difference = 1.52

Analysis of variance

SOURCES OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE, OR VARIANCE	COMPUTED VALUE OF F
Treatment	3	41.701	13.900	9.47 [a]
Error	16	23.484	1.468	
Total	19	65.185		

[a] Values of F with 3 and 16 degrees of freedom are 3.24 for 5 per cent and 5.29 for 1 per cent level of significance.

TABLE 2

The actual and computed mean yields of seeds in kilograms to a plot in the wet-season culture as influenced by the different treatments

TREATMENT	PLOTS					TREATMENT TOTAL	TREATMENT MEAN
	1	2	3	4	5		
I	28.0	31.4	30.4	25.0	23.4	138.2	27.640
II	25.2	21.6	21.0	23.8	24.6	116.2	23.240
III	23.4	21.0	16.0	21.6	21.8	103.8	20.760
IV	19.2	19.6	16.0	18.8	18.6	92.2	18.440
						Grand total	
Total	95.8	93.6	83.4	89.2	88.4	450.4	90.080
Plot mean ..	23.950	23.400	20.850	22.300	22.100	General mean	22.520

Least significant mean difference = 3.16

Analysis of variance

SOURCES OF VARIATION	DEGREES OF FREEDOM	SUM OF SQUARES	MEAN SQUARE, OR VARIANCE	COMPUTED VALUE OF F
Treatment	3	232.382	77.461	12.39 [a]
Error	16	100.048	6.253	
Total	19	332.430		

[a] Values of F with 3 and 16 degrees of freedom are 3.24 for 5 per cent and 5.29 for 1 per cent level of significance.

AN EXPERIMENTAL STUDY OF ODD-ROWED MAIZE EARS [1]

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WITH ONE TEXT FIGURE

Hepperly [2] reported the discovery of a nine-rowed ear of corn during the process of ear-sorting a commercial seed crop of 4-way hybrid maize. When planted, the grains of this ear produced odd-rowed as well as even-rowed ears.

In order to determine whether or not the formation of odd number of kernels follows a definite mode of inheritance, the writers studied the morphological features and genetic phenomena connected with the occurrence of odd-rowed corn ears. The work was conducted in the Department of Agricultural Botany from July, 1949, to October, 1950.

MATERIALS AND METHODS

Kernels of the College Yellow Flint variety obtained from one seven-rowed, 3 eleven-rowed, 3 thirteen-rowed, and 3 fifteen-rowed ears picked from the harvest of the College of Agriculture, were used.

A field prepared for planting was furrowed one meter apart and labeled with wooden tags attached to wooden markers. The first four rows were planted as guard rows. Beginning with the fifth row, every third furrow was planted to kernels obtained from the even-rowed ears (twelve- and fourteen-rowed ears) to serve as control. All the other furrows were planted to kernels from the odd-rowed ears. To minimize differences due to soil heterogeneity in the test field, the kernels were sown 50 centimeters apart in the furrows. When the corn plants were about 20 centimeters high, they were thinned to two plants to a hill.

There were about 50 hills in each furrow. In each of the furrows planted to the odd-rowed ears, two plants were bagged for selfing. The self-pollinated kernels were used as seed material for the subsequent planting.

The ears of corn were allowed to remain on the stalks until the husk and the grains were dry. These were then picked and later

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[1] Experiment Station Contribution No. 1595. Part of the thesis presented by the junior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1950.

[2] HEPPERLY, I. W. 1949. A corn with odd-rowed ears. Jour. Hered. 40 (3): 63–64.

husked. Precautions were taken to prevent mixing or loss of any of the labels attached. The number of kernel rows was then determined from each of the ears harvested.

Both the wet-season and dry-season plantings were done in the same lot. As stated earlier, the planting material for the second planting was taken from the self-pollinated plants, the progeny of odd-rowed parent plants raised in the dry-season culture. The dry-season planting was done on December 11, 1949, and the wet-season planting, on June 24, 1950.

RESULTS AND DISCUSSION

All of the test plants of the dry-season culture produced largely even-rowed ears. Table 1 shows the distribution of the number of ears from all types of parental seed material. The plants from odd-rowed ears also produced even numbers of kernel rows ranging from 8 to 18, with an average of 12 rows to the ear. There were 1158 twelve-rowed ears harvested, which represented 44.3 per cent of the total crop, 698 ten-rowed or 26.6 per cent, 641 fourteen-rowed or 24.4 per cent, 27 sixteen-rowed or 3 per cent, 36 eight-rowed or 1.4 per cent, and only 9 eighteen-rowed ears or 0.3 per cent of the total harvest. The coefficient of variation for this type of kernel-row variation amounted to only 4.9 per cent.

The ears produced from the self-pollinated plants of the dry-season culture followed almost the same pattern of distribution as that of the first crop, except for the slight variation in the number of odd-rowed ears produced. The selfed progeny from the seven-rowed plants died before reaching maturity, hence its absence in the wet-season culture.

Occurrence of odd-rowed ears in the selfed progeny. As shown in table 2, the eleven-rowed seed material produced one ear with the same number of rows and the thirteen-rowed likewise yielded

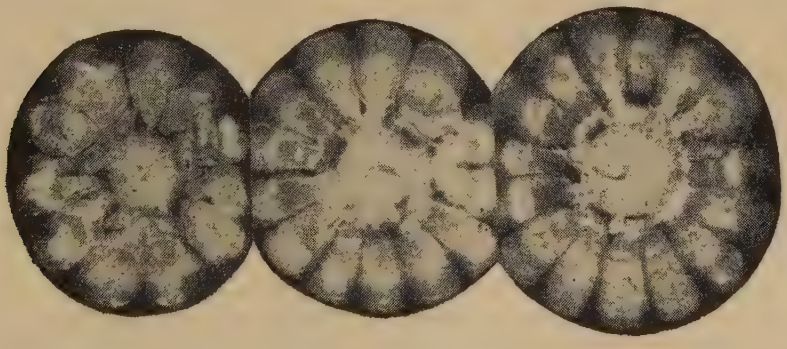

Fig. 1.—Left, a progeny of an eleven-rowed self-pollinated corn plant with 11 rows of kernel; center, a progeny of a thirteen-rowed self-polinated corn plant with 13 rows of kernel; right, a progeny of a fifteen-rowed self-pollinated corn plant with 15 rows of kernel.

three ears with 13 rows, whereas only one ear with 15 rows was produced from the fifteen-rowed parental seed (fig. 1). The occurrence of these five ears with odd rows of grains from the selfed plants of odd-rowed origin might have been accidental; the frequency was so low that it could have not been ascribed to genetic factors.

Morphology of carpellate inflorescence in maize. To understand the morphological structure of the corn flower as a means of correlating it with kernel-row arrangements, paraffin sections stained with haematoxylin-safranin of carpellate flowers were prepared and examined microscopically. The carpellate inflorescence is a thickened spike which ordinarily develops into an ear. According to Hayward,[3] the two flowers in the carpellate spikelet are enclosed by a pair of glumes and each flower is subtended by a lemma and palea which are much shorter than the glumes. He ascribes the two-ranked appearance of the mature grains on the ear to the manner in which the spikelets and their flowers develop. He further states that the pistillate spikelets are borne in pairs on very short branches which are ordinarily arranged in four or more longitudinal rows on the main axis. This arrangement ultimately produces an ear with eight or more rows of grains. Thus, these findings show that the occurrence of even-numbered kernel rows is the general rule in maize, because the anatomical features of the carpellate spikelets are such that they are generally associated with even-rowed kernel arrangement in the corn ear.

Apparently, the origin of the odd-rowed ears lies in the variation of the morphological development of the pistillate flowers. Normally, the staminate and pistillate spikelets have the same structural plan throughout and are identical in appearance in the early stages of development, although they differ greatly in appearance and function at the time of flowering. Each has two glumes, two lemmas, two paleas, and two flowers. All the parts of each flower in the spikelets of what is to be the male inflorescence develop uniformly to a certain stage; hence suppression of the pistil begins. The stamens and lodicules continue to develop, and the mature spikelets have two staminate flowers. At the time of the differentiation of the pollen mother cells in the anthers of the upper flowers, there occurs an extensive suppression of parts in which the entire lower flower and the stamens and lodicules of the upper flower are affected, so that at anthesis the spikelet leaves in functional form only a single pistillate flower.

This variation from the normal course of development on account of the extensive suppression of parts may explain the occurrence of odd numbers of kernel rows. In this development, only the stamens and the lodicules of the lower flower are suppressed and

[3] HAYWARD, H. E. 1938. The structure of economic plants. 1st ed. viii + 674 p., 340 fig. New York: The Macmillan Company.

the spikelet comes to anthesis with two finally fully developed pistillate flowers, ultimately producing two grains. The resulting crowding causes a rearrangement of grains and, often, erases all traces of the straight rows seen on an ordinary ear. Such phenomena rarely occur, but there is good evidence to prove that they are deviations from the normal. The present tests on the breeding behavior of odd-rowed kernels tend to show that there was no disturbance in the formation of two-ranked spikelets leading to the production of odd-rowed kernel rows.

SUMMARY

1. From the odd-rowed, self-pollinated plants in the culture with a total harvest of 686 ears, five ears with odd number of rows were produced; one ear with 11 rows from the eleven-rowed plants, 3 from the thirteen-rowed with a similar number of rows, and one fifteen-rowed from a like number of rows.

2. Structurally, the carpellate inflorescence of corn was made up of two-ranked spikelets, which normally developed into even-numbered kernel rows. The occurrence of single-ranked spikelet due to the abortion of one of the ranks in combination with two-ranked ones led to the development of odd-numbered kernel rows.

3. Ears with even-numbered rows were consistently produced by odd-rowed parental plants and no odd-rowed ears were obtained from the twelve- and fourteen-rowed control plants.

4. The progeny test of odd-rowed ears of Native Yellow Flint did not fully show indication of its hereditary basis, on account of an insignificantly low percentage of odd-rowed ear produced from similarly odd-rowed parental seed material.

5. The occurrence of odd-numbered kernel rows in maize may be considered a morphological change from a two-ranked to a single-ranked carpellate formation.

TABLE 1

Distribution of the progeny of the first crop of ears

NUMBER OF ROWS	NUMBER OF EARS PRODUCED FROM PARENTAL SEEDS						PERCENTAGE OF TOTAL
	Control (12 and 14 rows)	7-row	11-row	13-row	15-row	Total	
8	10	3	8	12	3	36	1.4
10	242	21	176	189	70	698	26.6
12	448	35	252	218	205	1158	44.3
14	211	20	156	118	136	641	24.4
16	19	2	26	18	14	79	3.0
18	0	0	6	2	1	9	0.3
Total	930	81	624	557	429	2621	100.0
Percentage of total	35.5%	3.1%	23.8%	21.2%	16.4%	100%	—
Average kernel row	12.0	11.9	12.0	11.8	12.4	12.0	—
Coefficient of variation	4.2%	2.2%	6.1%	5.5	6.5	4.9	—

TABLE 2

Distribution of the progeny of the second crop of ears

NUMBER OF KERNEL ROWS	NUMBER OF EARS PRODUCED FROM PARENTAL SEEDS					PERCENTAGE OF Total
	Control (12 and 14 rows)	11-row [x]	13-row [y]	15-row [z]	TOTAL	
6	1	0	1	0	1	0.1
8	2	1	3	3	9	1.3
10	52	31	41	31	155	22.6
12	100	95	53	58	306	44.7
14	72	69	26	29	196	28.6
16	7	3	6	2	18	2.6
18	0	0	1	0	1	0.1
Total	233	199	131	123	686	100.0
Percentage of total	34.0%	29.0%	19.1%	17.9%	100%	—
Average kernel row	12.2	12.3	12.1	12.1	12.2	—
Coefficient of variation	1.1	0.9	1.4	1.2	1.1	—

[x] One ear produced from eleven-rowed ear with 11 kernel rows.
[y] Three ears produced from thirteen-rowed ear with 13 kernel rows.
[z] One ear produced from fifteen-rowed ear with 15 kernel rows.

CARREON AND ININTIW AS SECONDARY CROPS IN SUCCESSION TO A PRIMARY RICE CROP [1]

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Calma and Palis [2] have shown that the rice varieties Inintiw and Sinariaya may be grown successfully as secondary crops in succession to the regular rice crop. A second experiment in which Carreon and Inintiw were used was conducted from May to October, 1944, in the Experiment Station of the College of Agriculture, Los Baños, Laguna. The seeds of these varieties were obtained from the Division of Annual Farm Crops, Department of Agronomy.

EXPERIMENT, RESULTS, AND DISCUSSION

Culture of the rice crop

The land, a 7,200-square-meter portion of the lowland rice fields, is fairly low and level. It has clay loam soil and had never been planted to any other crop but rice. After the last crop was harvested in February, the field was fallowed. Twelve plots of 300 square meters each, or a total area of 3,600 square meters, were allotted at random for each variety.

The land was plowed with a native plow on May 12, 1944, after the first rains. On May 29, 1944 the seeds were broadcast by hand, one ganta to a plot, or 33.33 gantas to a hectare. The field was then harrowed to cover the seeds.

The field was hand-weeded twice, on July 9 and on August 17, 1944.

External appearance of plants

Practically all of the seeds of the two varieties germinated ten days after having been broadcast in the field. Carreon had a better and more uniform germination than Inintiw. Both varieties had a fairly good stand in the field.

At the beginning, both varieties exhibited poor growth probably because of the weeds and the long dry spell that followed the broadcasting. Both varieties were pale green at the seedling stage. No differences in height, color, and growth were noted at this stage, but after the rains in July and August, 1944, marked differences were observed. Carreon turned dark green as it approached the

[1] Experiment Station Contribution No. 1596. Based on the thesis presented by the junior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1948.

[2] CALMA, V. C., AND N. C. PALIS. 1948. Inintiw and Sinariaya as secondary crops in succession to a primary rice crop. Philippine Agriculturist 32: 50–54.

fruiting stage, whereas Inintiw remained light green. Carreon was more vigorous than Inintiw.

Pests and diseases

When the grains were about to mature, the red rice weaver *(Munia atricapilla minuta)* began to feed on the grains, but the damage done by these birds was minimized by driving them away.

Both varieties were attacked by the rice stem borer (*Schoenobius incertellus* Walker). The damage, although regarded as being too small to affect materially the yields of the two varieties, was fairly well distributed in all the plots.

The rice bug *(Leptocorisa acuta* Thunberg), another common rice pest, also attacked the plants during the milk stage and sucked the contents of the developing grains. The bugs were few, however, and the damage was considered insignificant.

False smut *(Ustilaginoidea virens* [Cke.] Tak.) was observed on some plants, but the damage done was insignificant.

Another disease observed in the field was the glume spot *(Phyllosticta glumarum* [Ell. and Tr.] Miyake), which, likewise, did not cause any serious damage.

Height of plants

Carreon produced plants which were more uniform in height than those of Inintiw. Carreon had a mean height of 166.5 centimeters and Inintiw, 143.0 centimeters, or a mean difference of 23.5 centimeters. This difference in height of the plants was highly significant.

Bearing culms

Carreon had a mean of 5.2 bearing culms to the hill and Inintiw, a mean of 4.6. The difference was insignificant.

Flowering and maturity

Carreon flowered, on the average, 109.8 days after broadcasting, whereas it took Inintiw an average of 97.9 days to flower. The mean difference of 11.9 days is highly significant. Carreon matured on an average of 134.7 days and Inintiw, 121.6 days after broadcasting. The difference of 13.1 days was also highly insignificant. In this experiment, Inintiw matured almost two days later than the 120 days reported by Borja and Torres,[3] one day earlier than the 123 reported by Camus,[4] and five days later than the 117 days reported by Calma and Palis.[5]

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[3] Borja, V. and J. P. Torres. 1930. Fertilizer experiments on lowland rice. Philippine Jour. of Agric. 1: 247–271.

[4] Camus, J. S. 1921. Rice in the Philippines. Philippine Agric. Rev. 14: 7–28.

[5] Valeriano C. Calma and Norberto C. Palis. 1948. A comparative study of Inintiw and Sinariaya as secondary crops in succession to a primary rice crop. Philippine Agriculturist 32: 50–54.

Lodging

At maturity, Carreon lodged in 9 out of 12 plots, namely, 3, 5, 6, 8, 9, 11, 15, 17, and 18; Inintiw was semi-lodging only in plots, 10, 12, 16, 22, and 24.

Yield and milling percentage

Table 1 shows the yields of the two varieties. Carreon gave a mean yield of 73.21 kilograms to a plot of 300 square meters, and Inintiw, 41.61 kilograms. The mean difference of 31.60 kilograms was highly significant.

Based on 44 kilograms in a cavan, Carreon gave a computed yield of 55.50 cavans a hectare, and Inintiw, 31.52 cavans, or a mean difference of 23.98 cavans a hectare in favor of Carreon. Carreon gave a higher yield probably because it matured much later than Inintiw; in general the later a variety matures, the greater is its yield.

The yield of Inintiw in the present study was much lower than the 45.7 cavans a hectare reported by Camus (1921). This difference may be attributed to dissimilarity in soil and climatic conditions under which the crops were grown.

Carreon had a milling percentage of 64 and Inintiw, 60, or a difference of 4 per cent in favor of Carreon.

SUMMARY

1. Carreon was more uniform in height than Inintiw. Carreon, with a mean height of 166.5 centimeters, was significantly taller than Inintiw, with its mean height of 143.0 centimeters.

2. Carreon produced more bearing culms to a hill than Inintiw.

3. Because of its large panicles, Carreon lodged more than Inintiw.

4. Carreon flowered in 109.8 days and matured in 134.7 days after broadcasting. Inintiw, on the other hand, flowered in 97.9 days, matured in 121.6 days.

5. Both varieties were attacked by pests and diseases, but the damage caused was very slight.

6. Carreon, with its mean yield of 73.21 kilograms to a plot, or a computed yield of 55.50 cavans to a hectare, was significantly better than Inintiw with its average yield of 41.61 kilograms to a plot, or a computed yield of 31.52 cavans to a hectare.

7. Carreon had a milling percentage of 64, whereas Inintiw had only 60.

Based on these results Carreon should be preferred to Inintiw as a secondary rice crop.

TABLE 1

Comparative yield in kilograms

PLOT	VARIETIES		DIFFERENCE (C — I)
	Carreon	Inintiw	
1	64.96	48.52	16.44
2	68.70	25.10	43.60
3	92.17	43.94	48.23
4	68.54	41.40	27.14
5	90.50	46.61	43.89
6	72.68	40.46	32.22
7	70.85	47.76	23.09
8	61.43	39.25	22.18
9	68.79	40.80	27.99
10	71.29	40.26	31.03
11	89.54	39.57	49.97
12	59.11	45.72	13.39
Total	878.56	499.39	379.17
Mean	73.21	41.61	31.60

t = 4.109 (highly significant).

SOME PHYSICAL AND CHEMICAL PROPERTIES OF FOREST AND CULTIVATED SOILS [1]

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Since recently cleared soils produce more and better crops than after they have been cultivated for a time, a knowledge of some of the physical and chemical properties of forest and cultivated soils may help farmers and forestry men in their attempts to renovate old agricultural soils. Ten surface-soil samples consisting of five forest soils and five cultivated soils were subjected to physical and chemical methods of soil analyses in the Department of Soils of the College of Agriculture from November, 1949, to January, 1951. The forest soils were collected from the eastern slope of Mount Maquiling at the junction of the College of Agriculture Campus and the forestry reservation of the Bureau of Forestry. The cultivated soils were obtained from the fields of the College of Agriculture Experiment Station which have been continuously cultivated and cropped for at least 35 years.

Physical methods. The textural grade, water-holding capacity, sticky point, and rolling-out-limit of the samples were determined in accordance with the Piper (1947) methods.

Chemical methods. The organic matter content, total nitrogen content, pH value in one-tenth normal KCl solution, reserved plant foods dissolved by 10 per cent HCl, and the exchangeable bases in one normal, neutral ammonium acetate solution were determined by the methods of Eckstein, Jacob, and Alten (1931), the Association of Agricultural Chemists(1931) and (1945 editions) La Motte Universal pH outfit, the Second Commission of the International Society of Soil Science as modified by Blanck and Rieser (1928), and Merkle (1940), respectively.

RESULTS AND DISCUSSION

As table 1 shows the amount of fine soil particles, which are recognized in agriculture as contributing much to the fertility of soils, is lower in cultivated soils than in forest soils. Obviously, the micro-structure afforded by the humus layer in forest soils was disturbed by cultivation and cropping. This decrease may be readily understood when it is realized that the stickiness and activity of clay and the floury nature of silt counterbalance the non-sticky, gritty and inert characteristics of sand. It may also be seen in table 1

[1] Experiment Station Contribution No. 1597. Based on the thesis presented by the junior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, April, 1951.

that the results obtained on sticky point and rolling-out-limit are similar to that on fine soil particles. The water-holding capacity, on the other hand, appears to be the same in the two soils. From these findings, it may be inferred that film-water-soil relationships are closely related to clay content, but that the water-holding capacity is not.

In table 2, it appears that cultivated soils are appreciably poor in exchangeable calcium but evidently rich in exchangeable sodium. These differences may explain the tendency of old agricultural soils to become less permeable to water and harder to till. Baver (1948) stated that Na-saturated soils not only are more highly hydrated and dispersed than Ca-saturated soils but may also become impervious to water.

The same table shows that the difference of silica-sesquioxide ratio is significantly higher in forest soils, indicating that cultivation and cropping have removed the silica but have accumulated the sesquioxide, a phenomenon similar to the process of laterization.

As expected, forest soils contain comparatively higher amounts of reserved calcium, magnesium, and potassium. Other conditions being equal, forest soils, being well stocked with an abundant supply of compounds of calcium, magnesium, and potassium which are slowly made available for the use of plants by the action of physical, chemical, and biological forces, are more productive and can maintain high production level longer than soils not so stocked. Cultivated soils, however, are relatively rich in reserved sodium.

Forest soils contain the same amount of phosphoric acid as cultivated soil. This may indicate that the rate at which the phosporic acid reserve is made available for the plant is not so fast as the rate of calcium, magnesium, and potassium.

The organic matter, which is one of the contributing factors of soil fertility, is significantly lower in cultivated than in forest soils. The percentage of nitrogen is also lower in cultivated soils. These observations support the contention that soils rich in organic matter are also rich in nitrogen.

The soil reaction of cultivated soils, in spite of 35 years of continuous cultivation and cropping, have caused some degree of degeneration of their aggregate conditions. Lutz and Chandler (1947) stated that fine soil materials, organic matter, and lime are factors in the development of aggregates of different types.

SUMMARY

1. Five composite samples of forest soils and five of soils which have been continuously cultivated and cropped for the last 35 years were analyzed for some of their physical and chemical properties.

2. Of the physical properties, the silt and clay contents, sticky point, and rolling-out-limit varied significantly; the values for cul-

tivated soils were lower than those for forest soils. On the other hand, the sand content and water-holding capacity were not altered by 35 years of continuous cultivation and cropping.

3. In chemical properties, the amounts of organic matter, total nitrogen, and exchangeable calcium were higher in forest soils than in cultivated soils. The same was true with the reserved calcium, magnesium, and potassium. Sodium, however, accumulated in cultivated soils.

4. The SiO_2/R_2O_3–ratio decreased with cultivation and cropping, resulting in the loss of silica and accumulation of sesquioxide in cultivated soils.

5. The decrease of organic matter, fine particles, and exchangeable calcium in forest soils when they are put in cultivation showed that the old method of farming did not leave enough residues to balance the losses due to oxidation, absorption, and erosion; consequently, the desirable soil structure which abounds in forest soils suffered some degree of degeneration, making the soils vulnerable to run-off and erosion.

6. These results show that the old method of cultivation and cropping under climatic conditions obtaining in Los Baños led to soil depletion in the form of decreased organic matter, nitrogen, exchangeable calcium, and permeability. It is believed that these findings demonstrate what had taken place in the soil in the past and point the way to what must eventually take place in the future.

Recommendation. Considering the physical and chemical properties of forest soils to be nearer optimism conditions for crop production, the present study suggests that amelioration of old agricultural soils can be attained by the application of lime and organic nitrogenous fertilizer. Lime regenerates both directly and indirectly the physical, chemical, and biological properties of soils, whereas organic nitrogenous fertilizers in heavy soils, in the presence of adequate amount of lime, improve the granular structure and pore space which facilitate the movements of air and water-soluble soil constituents. The application of lime and organic nitrogen would minimize soil washing, blowing, baking, and crust forming. Lime and organic nitrogen would make light soils more retentive for water and water-soluble nutrients, including micronutrients, and would maintain the buffering property of soils and support the activities of useful microorganisms in the production of complex organic compounds and growth-promoting substances.

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TABLE 1

Physical properties of forest and cultivated soils

SAMPLES	CLAY	SILT	SAND	WATER HOLDING CAPACITY	STICKY POINT	ROLLING OUT-LIMIT
	per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*
			Forest soils			
FL	37.15	26.02	36.82	84.32	50.85	42.00
FM	38.18	25.37	36.44	90.42	57.30	52.43
FN	38.98	25.15	38.87	80.64	48.25	46.10
FI	43.23	31.80	24.97	75.25	44.26	41.26
FR	32.10	28.60	39.29	81.03	48.13	42.34
Mean	37.93	27.39	35.28	82.30	49.76	44.83
			Cultivated soils			
CUR	34.13	23.17	42.69	79.01	44.94	31.41
CC	29.15	24.90	34.13	79.98	35.11	31.26
CRH	27.28	24.25	48.47	74.58	38.86	33.65
CLR	58.33	16.40	25.27	80.93	33.95	30.28
CBT	31.73	24.57	43.74	73.38	43.18	42.72
Mean	36.12	22.66	38.86	77.18	39.21	33.86
Mean Diff. ..	1.81	4.73	3.58	5.12	10.55	10.97
Significance .	HS	S	I	I	HS	HS
t-value	3.83	2.83	1.09	1.78	3.93	3.55

Tabular t at 5 per cent level = 2.306
1 per cent level = 3.355

FL—Forest soil taken from the lumbang area
FM—Forest soil taken from the mahogany area
FN—Forest soil taken from the narra area
FI—Forest soil taken from the ipil-ipil area
FR—Forest soil taken from the rubber area
CUR—Cultivated soil taken from the upland ricefield
CC—Cultivated soil taken from the corn area
CRH—Cultivated soil taken from the U. P. Rural High School farmstead
CLR—Cultivated soil taken from the lowland ricefield
CBT—Cultivated soil taken from the back of the Agricultural Botany Building, College of Agriculture

TABLE 2

Chemical properties of forest and cultivated soils

SAMPLE	EXCHANGEABLE BASES IN M.E. PER 100 GRAMS SOIL				PLANT-FOOD HELD IN RESERVE (Soluble in 10 per cent HCl)						ORGANIC MATTER	TOTAL NITROGEN	pH IN ONE TENTH NORMAL KCl SOLUTION
	Ca	Mg	K	Na	SiO_2 / R_2O_3	CaO	MgO	K_2O	Na_2O	P_2O_5			
						per cent	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	*per cent*	
						Forest soils							
FL	24.85	4.99	1.49	8.36	0.18	0.82	0.19	0.50	0.69	0.17	7.18	0.26	5.85
FM	32.27	0.95	0.99	11.25	0.21	1.26	0.19	0.49	0.14	0.15	8.30	0.28	6.10
FN	12.85	8.46	0.99	14.16	0.17	0.87	0.19	0.49	0.72	0.19	6.51	0.09	5.55
FI	25.35	9.48	0.85	3.21	0.15	1.26	0.17	0.48	0.03	0.25	6.46	0.29	5.90
FR	20.85	9.48	0.99	0.96	0.11	0.60	0.42	0.47	0.53	0.23	5.87	0.06	5.60
Mean	23.23	6.67	1.06	7.59	0.16	0.96	0.23	0.49	0.42	0.20	6.86	0.20	5.80
						Cultivated soils							
CUR	12.85	6.48	0.99	27.31	0.09	0.42	0.18	0.16	0.88	0.09	5.86	0.23	5.40
CC	13.92	0.53	0.99	11.69	0.09	0.22	0.12	0.14	0.16	0.12	2.68	0.06	5.40
CRH	12.85	0.45	0.99	16.35	0.08	0.48	0.05	0.16	0.50	0.15	7.12	0.06	5.40
CLR	14.64	11.52	0.99	24.12	0.13	0.44	0.06	0.15	0.74	0.23	4.99	0.12	5.70
CBT	12.85	3.48	0.99	14.16	0.08	0.44	0.06	0.13	0.22	0.09	3.32	0.18	5.70
Mean	13.42	4.49	0.99	18.73	0.09	0.40	0.09	0.15	0.50	0.14	4.79	0.13	5.52
Mean Diff. ..	9.81	2.18	0.07	11.14	0.07	0.56	0.14	0.34	0.08	0.06	2.06	0.07	0.28
Significance .	HS	I	I	HS	HS	S	S	HS	HS	I	HS	HS	I
t-value	3.50	0.25	0.26	2.88	4.03	2.68	2.67	38.00	2.84	1.96	3.78	3.46	1.96

FL—Forest soil taken from the lumbang area
FM—Forest soil taken from mahogany area
FN—Forest soil taken from the narra area
FI—Forest soil taken from the ipil-ipil area
FR—Forest soil taken from the rubber area

Tabular t—5 per cent level 2.306
1 per cent level 3.355
I—Insignificant mean difference
S—Significant mean difference
HS—Highly significant mean difference

CUR—Cultivated soil taken from the upland ricefield
CC—Cultivated soil taken from the corn area
CRH—Cultivated soil taken from the U. P. Rural High school farmstead
CLR—Cultivated soil taken from the lowland ricefield
CBT—Cultivated soil taken from the back of the Agric. Botany Bldg., College of Agriculture

A COMPARATIVE STUDY OF THREE METHODS OF BROODING DUCKLINGS [1, 2]

CRESCENCIANO F. DE LA CRUZ AND F. M. FRONDA
Of the Department of Animal Husbandry

Duck raisers in the Philippines brood ducklings in houses with either dirt or concrete floors and provided with a good litter and either bare or grassy runs. Castillo (1948), using the sun porch,[3] and Igtanloc, (1941) the battery brooder, both obtained fair results in the raising of chicks. It is probable that these methods of brooding which have not yet been tried in the raising of ducklings may offer more advantages than the ordinary method. To compare these brooding methods, the present study was undertaken in the Department of Animal Husbandry from July, 1948, to March, 1949.

MATERIALS AND METHODS

Four hundred and twenty-six Mallard ducklings about three days old were used in this study. Three trials of three lots each were made, each trial covering a period of ten weeks. Lots I and II were housed in fireless brooding pens, each covered with a thick litter of rice hulls and provided with a small run of the same area, a bare-ground run for Lot I and a sun porch for Lot II. Lot III was raised in one of the four tiers of a battery cage measuring 4′ x 6′ x 6′ (121.9 x 182.9 x 182.9 centimeters), the sides and bottom of which were made of poultry wire with wooden frames.

After the ducklings had been randomly assigned to the three lots, they were legbanded and their initial weights were taken. Weighing was done every week thereafter until the end of the trial when the ducklings were ten weeks old. A Cenco balance with a maximum capacity of 2,000 grams and accurate to the tenth of a gram was used for weighing the ducklings.

All the ducklings were given identical rations each consisting of 60 parts of rice bran, 20 parts of ground corn, and 20 parts of fish meal.

The feed was given as sloppy mash four times a day—at 6:00 and at 10:00 o'clock in the morning and at 2:00 and at 6:00 o'clock

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[1] Experiment Station Contribution No. 1598. The data presented in this paper were taken from the thesis presented by the senior author for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1949.

[2] Part of the expenses incurred in this study were paid from a research grant by the National Research Council of the Philippines.

[3] By sun porch is meant the off-ground, roofless platform outside the house where the birds have access to direct sunlight.

in the afternoon. The ducklings were given as much feed as they could fully consume at each feeding time. Clean drinking water was accessible to the birds at all times of the day. Chopped green feed, mostly sweet potato leaves, was given in unlimited amounts twice a day.

The battery brooder used in this study was so located inside the laboratory that both the early morning and the late afternoon sun could reach the ducklings for at least one-half hour each time; hence, it was not found necessary to supplement with cod liver oil the ration of this lot. Leg-weakness was not observed among the ducklings raised in the battery brooder.

RESULTS AND DISCUSSION

Rate of growth. There was not much difference in the average initial weights of the ducklings in all the trials, the average initial weight of the ducklings in lot I being 41.7 $\mp$ 3.14 grams; in lot II, 42.5 $\mp$ 2.38 grams; and in lot III, 42.0 $\mp$ 2.77 grams. At the end of the second week, the ducklings in lot I in the third trial had increased in weight to almost three times their average initial weights, but those in lot III in the first trial had only doubled their average initial weights. The birds in the other lots in the three trials had more than doubled their respective average initial weights. Jongo (1951) reported that at the age of two weeks, the ducklings had increased their weights to almost three times their average initial weights. Fronda and Cruz (1931), however, observed that at this age the ducklings had only almost doubled their weights.

In the first trial, the average weight of the ducklings in lot I at the age of ten weeks was 920.0 $\mp$ 19.86 grams; in lot II, 893.9 $\mp$ 26.72 grams; and in lot III, 892.8 $\mp$ 39.03 grams. In the second trial, the average weights of the ducklings were 846.8 $\mp$ 39.60 grams in lot I, 869.2 $\mp$ 42.36 grams in lot II, and 849.3 $\mp$ 37.12 grams in lot III; those in the third trial were 896.3 $\mp$ 28.97 grams for lot I; 845.0 $\mp$ 32.69 grams for lot II; and 795.8 $\mp$ 38.04 grams for lot III. Thus, at the age of ten weeks, the average weight of the ducklings in lot I was 887.7 $\mp$ 37.35 grams; in lot II, 869.0 $\mp$ 24.45 grams; and in lot III, 846.0 $\mp$ 48.25 grams. These figures show that the ducklings in lot I were only 18.3 grams heavier than those in lot II and 41.7 grams heavier than those in lot III. The ducklings in lot II were 23.4 grams heavier than those in lot III. The standard error of the mean difference showed these differences to be insignficant.

In the first trial, although the average weekly increase in weight of the ducklings in lot I was higher than those in lots II and III, the differences were not significant. In the second trial, the ducklings in lot II had a slightly higher average weekly increase in weight than those in lots I and III, whereas in the third trial, lot I had a higher average weekly increase in weight than either lot II or lot III, and lot II, slightly higher than lot III. In both the second and the

third trials, differences in the average weekly increase in weight in the three lots were insignificant.

Feed consumption and feed cost. Lot III consumed the least amount of feed to produce a kilogram gain. On the average, lot III required only 4.82 kilograms feed for every kilogram gain in weight, while lot II consumed 4.99 kilograms, and lot I, 5.07 kilograms. Lot III was thus 3.4 per cent more efficient than lot II and 4.4 per cent more efficient than lot I; lot II was 1.5 per cent more efficient than lot I. The little difference in feed consumption between lot I and lots II and III may be partly accounted for by the fact that the ducklings in lot I were a little more nervous than those in lot II and lot III. A slight external disturbance caused these birds to run to and fro inside the pen and therefore waste energy which otherwise would have been utilized in gaining weight. The fact that the ducklings in lot I were slightly heavier, although not significantly so, than those of either lot II or lot III may have also influenced in part the amount of feed consumed by them.

The returns above the costs of feed derived from the three lots were also determined. Based on 100 ducklings raised to ten weeks of age, lot I gave returns of ₱4.58; lot II, ₱4.69; and lot III, ₱10.53. It will be seen, therefore, that raising ducklings in the battery brooder not only required a little less feed than raising them in the usual way but also gave the biggest returns above cost of feed. The ducklings raised on the sun porch consumed a little more feed to produce a kilogram gain in weight and gave less returns above cost of feed than those in the battery brooder.

Mortality. It was observed in this study that the first three weeks after hatching was most critical period in the life of the ducklings in the three lots. Due to the nervous disposition of the ducklings in the sun porch and of those in the ground run, a slight disturbance caused them to stampede and crowd in one corner of the pen and trample the weaker ones to death. In lots II and III, a few birds died on account of accidental insertions of the legs between the bamboo slats and the netted wires. The mortality in trial 1 was 17.3 per cent in lot I, 11.5 per cent in lot II, and 25.0 per cent in lot III; in trial 2, 48.9 per cent in lot I, 53.7 per cent in lot II, and 61.0 per cent in lot III; and in trial 3, 8.2 per cent in lot I, 14.3 per cent in lot II, and 18.4 per cent in lot III. Based on the averages of these figures, lots I and II had about the same mortality: 24.8 per cent in lot I and 26.5 per cent in lot II, both being lower than that of lot III, which had 34.8 per cent. The high mortality rates of the ducklings in all the lots of the second trial may have been due to the low vitality of the ducklings used in this particular trial.

Other observations. As expected, having been raised off the ground and therefore out of contact with mud and excreta, the ducklings raised in the battery cage were cleaner in appearance than those on the ground run and in the sun porch. The battery-cage

ducklings were observed to be less nervous than those raised in the sun porch and on the ordinary ground run. There was no noticeable difference in the health and vigor of the ducklings in all the lots.

SUMMARY

1. There were no significant differences in the weight of 10-week old ducklings raised in three methods of brooding; namely, the ground run, the sun porch, and the battery brooder.

2. The ducklings raised in the battery brooder required slightly less feed to produce a kilogram gain in weight than those raised either on the sun porch or on the ground run.

3. The battery brooder lot had the highest returns above cost of feed; the sun porch lot, the second; and the ordinary ground run lot, the lowest.

4. The percentage of mortality of the ducklings was about the same in lots I (ground run) and II (sun porch), being 24.8 in lot I and 26.5 in lot II. Both lots had a lower mortality rate than lot III (battery cage), which had 34.8 per cent.

5. The ducklings raised in the battery cages were tidier in appearance than those raised either on the sun porch or on the ground run.

6. It appears that the use of the sun porch offered no advantage over the ordinary method of brooding ducklings. The battery brooder, however, may be used profitably in brooding ducklings to the weaning age of 10 weeks.

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TABLE 1

Average weights of the ducklings, feed consumption, and returns above feed cost (based on 100 ducklings raised to 10 weeks of age)[a]

ITEMS	LOT I (Ground run)	LOT II (Sun porch)	LOT III (Battery brooder)
Total weight of ducklings at 10 weeks of age, kilograms	88.77	86.94	84.60
Returns from sale of ducklings at ten weeks, pesos[b]	133.16	130.40	126.90
Total amount of feed consumed, kilograms	428.6	412.4	387.9
Total cost of feed consumed, pesos[c]	128.58	123.72	116.37
Feed required for a kilogram gain, kilograms	5.07	4.99	4.82
Cost of feed to produce a kilogram gain, pesos	1.521	1.497	1.446
Returns above cost of feed, pesos	4.58	4.69	10.53

[a] Average of three trials
[b] Based on ₱1.50 a kilogram live weight
[c] The cost of feed was 30 centavos a kilogram.

A STUDY OF TWO MASH MIXTURES FOR LAYING PULLETS [1]

RAMON N. MACAPAGAL

Castillo [2] found that the College chick ration fed to Single Comb White Leghorn chicks produced heavier birds, lowered the rate of mortality, and required less amount to produce one kilogram of gain in weight than the imported feed.

As the use of imported feed mixtures for laying pullets, now available in the market at more stationary prices, may become more advisable, a comparative study of the College laying mash and any imported laying mash in efficiency and economy of egg production was undertaken in the Department of Animal Husbandry from May 12, 1947, to May 11, 1948.

MATERIALS AND METHODS

One hundred young New Hampshire laying pullets, which were raised from among the batch of day-old chicks shipped by air from the United States in 1946, were randomized into two lots of 50 pullets each. Lot 1 was fed the College laying mash and lot 2, a laying mash imported from San Francisco, California. Both lots were housed under the same roof in adjacent pens provided with ample yards.

The College laying mash consists, all parts by weight, of one part ground yellow corn, two parts shrimp meal, three parts copra meal, and four parts fine rice bran. The constituents of the imported mash are not known, the mash being a "closed-formula" feed. The Department of Agricultural Chemistry of the College gave the following proximate chemical analysis of these mashes:

	COLLEGE LAYING MASH	IMPORTED MASH
Moisture	10.88	9.29
Crude protein (N × 6.25)	23.38	22.06
Crude fats (Ether extract)	10.46	2.00
Carbohydrate (N.F.E.)	38.60	48.73
Calorific value per 100 grams	342.00	301.00
Crude fiber	7.98	7.18
Ash	8.70	10.74

The same amounts of grain mixture were given to the two lots. From May 12, 1947, to January, 1948, corn alone was given; from

[1] Experiment Station Contribution No. 1599. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, 1949. Prepared in the Department of Animal Husbandry under the direction of Professor F. M. Fronda.

[2] CASTILLO, LEOPOLDO S. 1948. A study of the influence of two chick rations and two methods of brooding on the rate of growth and mortality of chicks. Philippine Agriculturist **32**: 124–137.

February to the end of the experiment, May 11, 1948, the grain mixture consisted of equal parts of corn and palay (unhulled rice grains).

The pullets were fed the College growing ration from weaning time to the start of this study. In lot 2 the change of feed was made gradually by mixing the imported feed with the College laying mash the first few days of the experiment, and by gradually removing the local feed as the birds were getting used to the imported one.

The rations were made available to the lots in open-feeding troughs kept filled all the time. During the first few days of the experiment when the weather was hot, enough water was added to the dry mash to make it moist and crumbly and readily consumable in 20 to 30 minutes. The wet mash induced the birds to consume more feed and accustomed them to the new feeds, particularly to the imported one. Drinking water was supplied at all times.

The birds were allowed a grassy run, but additional chopped green feed was given regularly twice a week to supplement the rations and the green feed that they got in the yards. Ground shell was placed in open wooden troughs inside the pens. The individual initial and monthly weights of the birds, trapnest records, feed consumption, mortality, and other pertinent data were taken.

RESULTS AND DISCUSSION

Effect of the two rations on the weight of the birds.

The weights of the birds at the beginning and at the close of the experiment show that both lots gained in weight (table 1). This may be accounted for by the fact that the birds were young pullets at the beginning of the experiment and had not yet attained their maximum body weight. The fluctuations in the monthly weights of the birds, during the entire period, however, were probably due, in part, to the slight changes in the feed composition when shrimp meal was not available for the College laying mash, and to sickness (the birds in lot 1 had the lowest average weight in July, when four deaths due to roup occurred). The general trend, however, was a gradual increase in weight from the start to the end of the study.

The average initial weight of the birds in lot 1 was heavier by approximately 12 per cent than that in lot 2 (table 1). Lot 1 exceeded lot 2 in final weight by only 5.1 per cent. The average initial weight for lot 1 was 1625.4 grams, and the average final weight was 2094.3 grams, or an increase of 28.8 per cent; for lot 2 the average initial weight was 1446.6 grams and the final weight, 1991.7 grams, or an increase of 37.8 per cent.

Mortality. As regards mortality, the imported laying mash had no apparent advantage over the College laying mash; 15 out of the 50 pullets, or 30 per cent, died in lot 1, and 14 out of 50 pullets, or 28 per cent, died in lot 2 (table 1). Post-mortem examinations of

the dead birds revealed symptoms (Barger and Card, 1943) [3] of roup in nine birds in lot 1 and seven in lot 2; tuberculosis in one in lot 1 and two in lot 2, and egg-bound in five in lot 1 and four in lot 2. The cause of the death of one bird in lot 2 could not be determined.

Egg production. The total number of eggs produced during the year (from May 12, 1947, to May 11, 1948) in lot 1 was 5985 eggs, or 145 eggs a layer (table 2). The individual production of the birds in this lot ranged from 20 to 237 eggs a year. In lot 2 the birds laid only 4233 eggs during the same period, or an average of only 100 eggs a hen during the year. The individual egg production in lot 2 varied from 31 to 188 eggs a year. The birds in lot 1 had an average egg production of 39.6 per cent, and those in lot 2, 27.3 per cent. If lot 1 is considered 100 per cent efficient, lot 2 is only 68.9 per cent efficient.

The low egg production during the first four months of the birds in lot 2 may be due their adjusting themselves to the new feed. It was also during this period when about one-fourth of the birds in lot 2 suffered from roup. When the composition of the College laying mash was slightly altered on the eleventh month (March 12-April 11), the percentage egg-production of lot 1 was higher all the time than that of lot 2. The peak of the laying period for lot 1 was reached on the third month (July 2-August 11) and that of lot 2, on the tenth month (February 12-March 11), but the effect on egg production of the two feed mixtures in lot 1 and lot 2 was very apparent from the fifth month (September 12-October 11) to the tenth month (February 12-March 11). The low egg production on the fourth month (August 12-September 11) may be ascribed to the molting of the birds, and that on the eleventh month (March 12-April 11) to the heat of summer.

Amount and value of feeds consumed. The average amount of feed consumed by each pullet in both lots was 32 kilograms in one year (table 3). Although both mash mixtures were equally relished, the birds in lot 2 consumed more mash than those in lot 1. The average cost of one kilogram of the College laying ration was approximately 27 centavos and that of the imported mash, 31 centavos. Lot 1 produced a total of 5985 eggs, or 1752 more than that of lot 2. At the average price of 15 centavos an egg, the total return from lot 1 was ₱898 and from lot 2, ₱635. The sale of eggs less the cost of feed netted lot 1 ₱541 and lot 2, ₱208. To produce one dozen eggs, lot 1 required 2.63 kilograms of feed costing 71 centavos and lot 2, 3.95 kilograms, costing ₱1.22.

Other minor observations. Most of the birds in lot 1 were usually seen out in their yard, whereas the birds in lot 2 were rarely noticed outside. At the end of the experiment, the yard of the former was bare of vegetation, whereas there was still heavy growth

[3] Barger, E. H. and L. E. Card. 1943. Diseases and parasites of poultry. 449 p. Philadelphia: Lea and Febiger.

of grass in the yard of lot 2. The presence of a considerable amount of powdered green feed in the imported mash, which gave it a greenish color, may be one of the reasons why the birds in lot 2 did not feed much on the grass in their yard.

SUMMARY

1. For egg production in laying New Hampshire pullets, the College laying mash was superior to the imported laying mash.

2. The average feed consumption of each bird in lots 1 and 2 in one year was 32 kilograms. Both the College and the imported laying mashes were equally relished by the birds.

3. To produce one dozen eggs, the College laying mash required 2.63 kilograms valued at 71 centavos, whereas the imported mash required 3.95 kilograms valued at ₱1.22.

4. The mortality was practically the same in the two lots.

TABLE 1

Number and average weights of birds at the beginning and at the end of the experiment

ITEMS	LOT 1 College-mash fed	LOT 2 Imported-mash fed
Number of birds at the beginning, May 12, 1947	50	50
Average weight of the birds at the beginning, gms.	1625.4	1446.6
Number of birds at the close, May 11, 1948	35	36
Average weight of the birds at the close, gms. ..	2094.3	1991.7
Average increase in weight, gms.	468.9	547.1
Percentage increase	28.8	37.8
Number of birds that died during the year	15	14
Percentage of mortality during the year	30.0	28.0

TABLE 2

Effect of the rations on egg production

PERIODS	LOT 1 COLLEGE-MASH FED		LOT 2 IMPORTED-MASH FED	
	Number of eggs laid	Percentage of egg production	Number of eggs laid	Percentage of egg production
May 12–June 11	393	25.4	317	20.5
June 12–July 11	355	23.4	60	4.1
July 12–August 11	813	50.6	85	6.2
August 12–September 11	392	22.3	271	19.9
September 12–October 11	526	42.5	382	29.2
October 12–November 11	545	43.5	408	31.0
November 12–December 11 ...	569	48.6	463	37.4
December 12–January 11	547	45.2	436	34.6
January 12–February 11	600	49.6	540	43.5
February 12–March 11	536	49.6	528	47.3
March 12–April 11	324	28.1	369	32.6
April 12–May 11	385	35.9	374	34.6
Total	5985	—	4233	—
Average production per bird ..	144.9	39.6	99.9	27.3

TABLE 3

Amount and cost of feed consumed, returns from eggs produced, and efficiency of the rations studied

ITEMS	LOT 1 COLLEGE-MASH FED		LOT 2 IMPORTED-MASH FED	
	Amount	Value	Amount	Value
		pesos		*pesos*
Total feed consumed ...	1312 kgm.	356.37	1393 kgm.	426.51
Average feed consumed	32 kgm.	8.64	32 kgm.	9.92
Total eggs produced ...	5985	897.75 [a]	4233	634.95
Average egg production per bird	144.9	21.74	99.9	14.99
Relative efficiency, per cent	100.0	—	68.9	—
Returns above feed consumed	—	541.38	—	208.44
Feed to produce one dozen eggs	2.63 kgm.	0.71	3.95 kgm.	1.22
Relative efficiency, per cent	100.0	—	66.6	—

[a] Based on ₱1.80 a dozen.

COLLEGE AND ALUMNI NOTES

The following members of the faculty attended the 1951 U.P. faculty conference in Baguio: Dean L. B. Uichanco; Drs. F. O. Santos, F. M. Fronda, S. M. Cendaña, F. M. Sacay; Prof. A. P. Aglibut, Mrs. M. I. Sevilla, Mr. G. F. Saguiguit, and the Misses C. R. Alcaraz, C. R. Baltazar, and T. L. Pronove.

The opening exercises for the 1951-52 school year were held on Friday morning, June 29, 1951 at the Agricultural Chemistry Lecture Hall. Among the numbers in the program were: opening remarks by Mr. N. B. Tablante, of the committee on social affairs; instrumental selection by Agustin Pordesimo, '54; talk for the student body by Quirino Villaviza, '52; vocal duet by Petra Baes, '54 and Silverio Revilleza, '55; talk for the coeds by Gloria Vega, '53; saxophone selection by Severo Osoteo, '55; vocal solo by Marina Escritor, '54; and closing remarks by Dean L. B. Uichangco. During the program, a large number of students and the majority of faculty members had to stand outside the hall, which could not accommodate the increased campus population.

The final report on enrollment as released by the Office of the Secretary reveals that the College has 798 students, excluding 51 cross-registrants from the College of Forestry, or an increase of 262 over that of last year. The 798 students are classified as follows: freshmen, 528; sophomore, 135; junior, 71; senior 53; postgraduate, 8; and special 3. There are 49 girls in the student body.

The following first-year students were granted entrance scholarship: Valentino G. Argoñosa, Tarcela S. Bag-ao, Fernando A. Bernardo, Felicitas L. Cortes, Marino S. Domingo, Rodolfo M. Ela, Rosendo R. Estoye, Jr., Aurora E. Fronda, Ramon A. Ibarbia, Feliciano C. Manuel, Crescencio M. Primer, Vivencio L. Quiñon, Leo Cacdac Rimando, Nerius J. Roperos, Angelito V. Sandoval, Angel V. Sobrepeña, Feliciano B. Subang, Bienvenido P. Tamayo, and Ramon V. Valmayor. Each of these students was either a valedictorian or a salutatorian of his class in the high school.

In the University Rural High School, 211 students are enrolled. This represents an increase of 42 students over that of last year.

A curriculum designed primarily for girls was approved by the University Council on June 12, 1951. Completion of the curriculum leads to the degree of Bachelor of Science in Home Technology. Although approved only two weeks before the opening of the 1951-52 academic year, nine girls are now enrolled in the first year.

The leaders and advisers of the student organizations in the College are as follows: Student Body Organization—Quirino Villaviza, president, and Dr. V. C. Calma, adviser; Senior Class—Severino R. Santos, Jr., president, and Mr. N. B. Tablante, adviser; Junior Class—Lino E. Nazareno, president, and Mr. N. B. Tablante, adviser; Sophomore Class—Francisco Ascalon, president, and Prof. A. B. Catambay, adviser; Freshman Class—Archimedes Laurel, president, and Dr. S. M. Cendaña, adviser; Speech and Dramatics Club—Faro B. Benitez, president, and Mrs. Marcela I. Sevilla, adviser; Ranchers' Club—Mauro Ruma, governor, and Dr. F. S. Mensalvas, adviser; Philippine Country Life Association—Emilio Quintana, president, and Dr. F. M. Sacay, adviser; Associated Women Students' Association—Lilia V. Hosillos, president, and Mrs. Obdulia F. Sison, adviser; Upsilon Sigma Phi—Jose O. Juliano, illustrious fellow, and Dr. F. T. Orillo, adviser; Beta Sigma, Los Baños Chapter—Rodolfo Ylarde, president, and Dr. D. L. Umali, adviser; U.P.S.C.A., Los Baños Chapter—Vito del Fierro, Jr., chairman, and Mr. Rodrigo Guillermo, adviser; Soil Tillers Photographic Club—Rodolfo V. Torreda, president, and Mr. A. P. Varona, adviser; and Mimes Mummers Scribblers Fraternity—Romeo V. Aquino, grand consul, and Dr. A. G. Tan, moderator.

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